

**Installation Restoration Program  
Final Fourth Quarter 1999-2000  
Groundwater Monitoring Report**

**143rd Combat Communications Squadron  
Seattle Air National Guard Station  
Washington Air National Guard  
Seattle, Washington**

**September 2000 -**



**Air National Guard  
Andrews AFB, Maryland**

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Final Fourth Quarter 1999-2000  
Groundwater Monitoring Report**

**143rd Combat Communications Squadron  
Seattle Air National Guard Station  
Washington Air National Guard  
Seattle, Washington**

**September 2000**

**Prepared For:**

**Air National Guard  
Andrews AFB, Maryland**

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## LIST OF ACRONYMS/ABBREVIATIONS

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<u>Acronym/ Abbreviation</u>	<u>Definition</u>
ANG	Air National Guard
ANGS	Air National Guard Station
ARAR	Applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
CCSQ	Combat Communications Squadron
cis-1,2-DCE	cis-1,2-Dichloroethene
COC	Contaminant of concern
ERM	Environmental Resources Management
IRP	Installation Restoration Program
µg/l	Micrograms per liter
MTCA	Model Toxics Control Act
PCE	Tetrachloroethene
pH	Acidity/alkalinity
PSG	Project screening goal
QA/QC	Quality assurance/quality control
QC	Quality control
RI	Remedial Investigation
TCE	Trichloroethene
VOC	Volatile organic compound
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

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Groundwater samples were collected in May 2000 at the Seattle Air National Guard Station in Seattle, Washington, as part of a quarterly groundwater monitoring program. Thirteen monitoring wells were sampled using low-flow purging and sampling methods. The groundwater samples were analyzed for volatile organic compounds.

Static water levels were measured in the monitoring wells prior to purging and sampling the wells. Measured depths to water ranged from approximately 7 to 10 feet below ground surface. The inferred groundwater flow direction was toward the south-southwest, consistent with previous observations.

Chlorinated volatile organic compounds (VOCs) were detected in six monitoring wells. The detected concentrations were below Washington State Model Toxics Control Act Method A Cleanup Levels. Detected compounds include:

- Tetrachloroethene at a concentration of 1.22 micrograms per liter ( $\mu\text{g/l}$ ) in well MW-9 and 3.55  $\mu\text{g/l}$  in well BS-004PZ;
- Trichloroethene (TCE) at concentrations of 1.19 to 4.99  $\mu\text{g/l}$  in wells MW-4, MW-6, MW-7, and MW-8;
- cis-1, 2-Dichloroethene at a concentration of 1.29  $\mu\text{g/l}$  in well MW-8; and
- 1, 1, 1-Trichloroethane at a concentration of 1.25  $\mu\text{g/l}$  in well MW-9.

Time series plots of contaminant concentration versus groundwater elevation were produced for select monitoring wells. Portions of the data for wells MW-4 and MW-8 indicate an apparent correlation between dissolved contaminant concentrations and temporal water table fluctuations.

The source of the chlorinated VOCs detected in groundwater has not been identified. Observed TCE concentrations in monitoring wells MW-4 and MW-8 appear to depend in part on groundwater elevation, which suggests that there may be a residual contaminant source (e.g., sorbed-phase VOCs) in soils near the water table proximal to these wells.



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As discussed in the Phase II Remedial Investigation Report (ERM 1999a), the TCE detected in monitoring wells in the southern portion of the site may be related to the dissolved TCE plume beneath the Boeing Area 3-360 facility immediately south of the Seattle Air National Guard Station.

## SECTION 1.0

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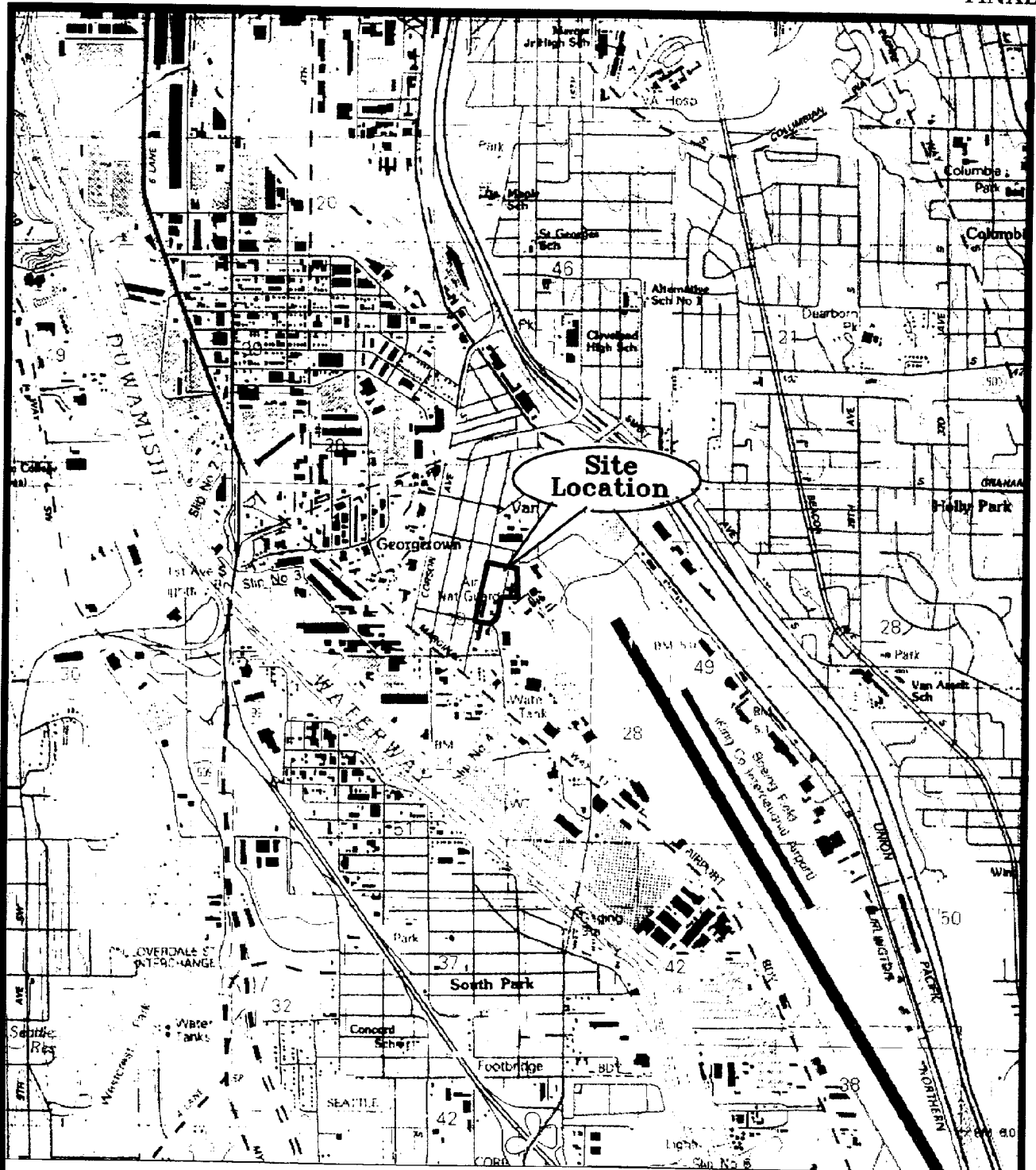
## INTRODUCTION/BACKGROUND

This report summarizes the methods and results of the quarterly groundwater sampling event conducted on 30 and 31 May 2000 at the Seattle Air National Guard Station (Seattle ANGS) in Seattle, Washington (Figure 1-1). Groundwater monitoring has been conducted at the site since September 1996 as part of the Air National Guard (ANG) Installation Restoration Program (IRP). Environmental Resources Management (ERM) performed the work under National Guard Bureau Contract DAHA90-94-D-0014, Delivery Order 0067. The Air National Guard/Installation Restoration Program Branch provided technical and project management oversight of the work.

The Seattle ANGS is at 6736 Ellis Avenue South in Seattle, Washington, and occupies approximately 7.5 acres near the north end of the King County International Airport (Boeing Field). A map of the Seattle ANGS is shown in Figure 1-2. The Seattle ANGS is currently the home of the 143rd Combat Communications Squadron (CCSQ). The mission of the 143rd CCSQ is to provide mobile communication equipment and support for airports and airfields. The facility employs approximately 129 personnel, of which 25 are full-time employees.

The Seattle ANGS site was originally developed during World War II by the War Department, and was used by the United States Army Air Corps as an "Aircraft Factory School" from 1943 to 1948. In 1948 the property was given to King County as surplus property and was subsequently leased to the Washington ANG. On 21 April 1948, the 143rd Aircraft Control and Warning Squadron was established on the site. From May 1951 to February 1953, the 143rd was activated for recruitment purposes. During this period the unit had two C-47 aircraft. In 1960 the name of the unit was formally changed to the 143rd Communications Squadron Tributary Teams. In 1969 and 1988 the name of the unit was again changed, becoming the 143rd Mobile Communications Squadron and the 143rd CCSQ, respectively.

Currently, the Seattle ANGS property is leased from King County by the United States Air Force, which in turn licenses the property to the Washington State Military Department for ANG use.



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Photographed 1977, Map Edited 1983.  
Seattle South, Washington

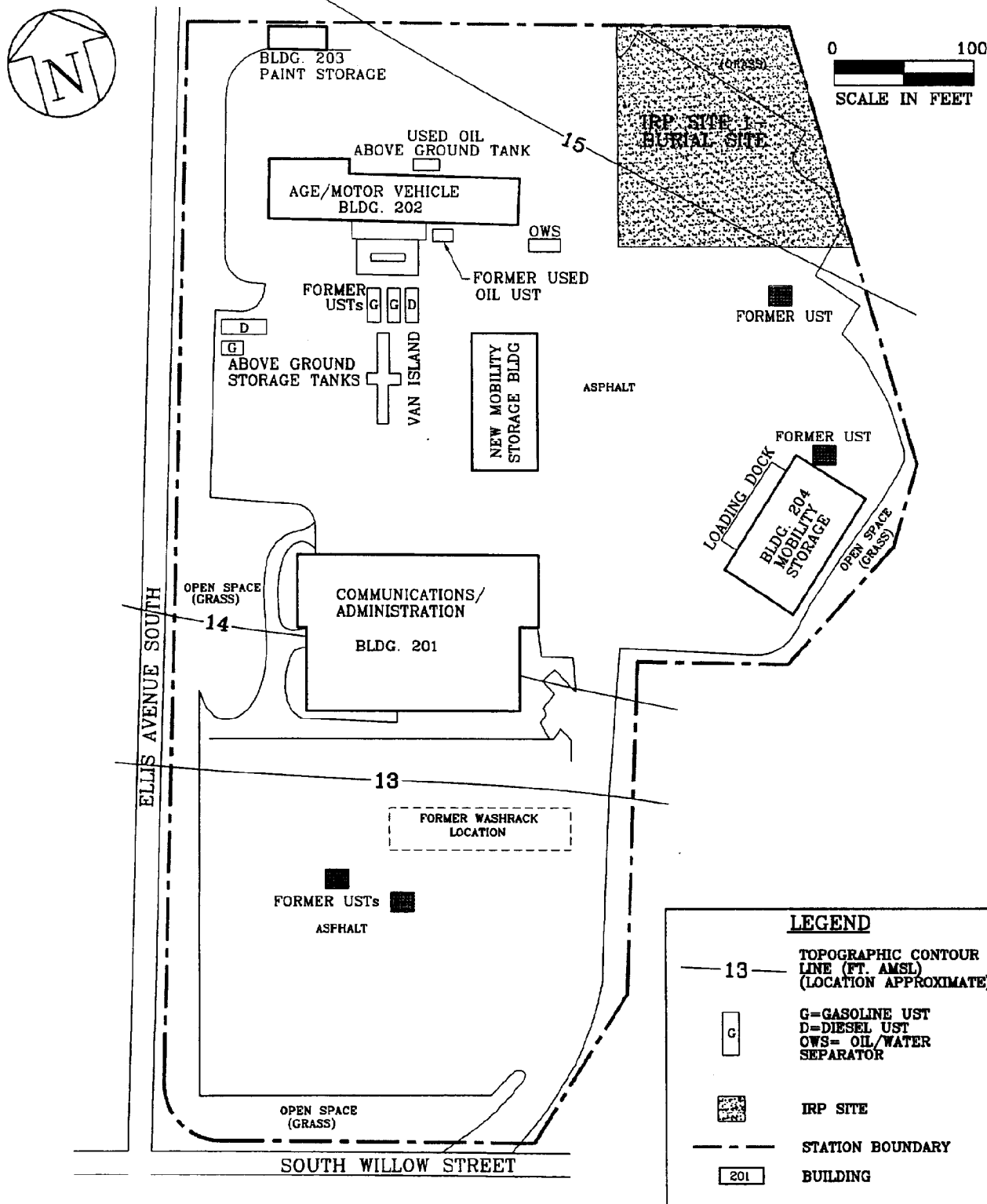
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LOCATION MAP OF SEATTLE  
AIR NATIONAL GUARD STATION  
SEATTLE, WASHINGTON  
143rd CCSQ, Seattle ANG  
Seattle, Washington

FIGURE 1-1

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# SITE MAP

143rd CCSQ, Seattle ANG  
Seattle, Washington

FIGURE 1-2

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Three IRP investigation phases have been completed at the Seattle ANGS:

- A Preliminary Assessment, conducted by the ANG in December 1993;
- A Preliminary Assessment/Site Inspection, conducted by Operational Technologies Corporation in 1994; and
- A two-part Remedial Investigation/Feasibility Study, conducted by ERM between 1996 and 1999.

The scope and results of these IRP investigations are summarized in the Phase II Remedial Investigation (RI) and Feasibility Study Reports (ERM 1999a, 1999b). Numeric project screening goals (PSGs) were developed during the RI for use in identifying contaminants of concern (COCs) in soil and groundwater. The PSGs were derived from chemical-specific State and Federal applicable or relevant and appropriate requirements (ARARs). The derivation of PSGs and the screening process used to identify COCs are described in the Phase II RI Report (ERM 1999a).

Two chlorinated volatile organic compounds (VOCs) - trichloroethene (TCE) and tetrachloroethene (PCE) - have been detected in groundwater at concentrations above PSGs. Isolated detections of PCE have occurred in two background (upgradient) monitoring wells and four site-characterization wells; the majority of the PCE detections have been below the Washington State Model Toxics Control Act (MTCA) Method A Cleanup Level of 5.0 micrograms per liter ( $\mu\text{g}/\text{l}$ ). Dissolved TCE in groundwater is the only consistently detected COC at the Seattle ANGS that may pose a potential threat to human health or the environment. TCE has been detected at concentrations up to 83  $\mu\text{g}/\text{l}$  in shallow groundwater in the southern portion of the Station. The MTCA Method A Cleanup Level for TCE is 5.0  $\mu\text{g}/\text{l}$ .

An on-site source area for the TCE detected in groundwater has not been identified. Out of 27 soil samples analyzed for VOCs during the RI, only one was found to contain TCE. The TCE concentration reported in this sample (0.17 milligrams per kilogram) was below the MTCA Method A Soil Cleanup Level of 0.5 milligrams per kilogram. Furthermore, this soil sample was collected at the depth of the water table (approximately 10 feet below ground surface) in the southern portion of the Station, and thus may have contained TCE-impacted groundwater that biased the analytical results. Chlorinated VOCs were not detected in any of the other RI soil samples. As discussed in the Phase II RI Report (ERM 1999a), the groundwater data suggest that the dissolved TCE detected in monitoring

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wells at the Seattle ANGS may be related to groundwater contamination at the Boeing Area 3-360 facility immediately south of the Station. Concentrations of TCE up to 1,300 µg/l have been detected in monitoring wells at the Boeing site.

## SECTION 2.0

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***FIELD ACTIVITIES***

This section provides a summary of field activities performed during the May 2000 quarterly groundwater sampling event. Groundwater sampling was conducted on 30 and 31 May 2000 in accordance with the procedures detailed in the 1999-2000 Groundwater Monitoring Work Plan (ERM 1999c). Figure 2-1 shows the locations of the monitoring wells.

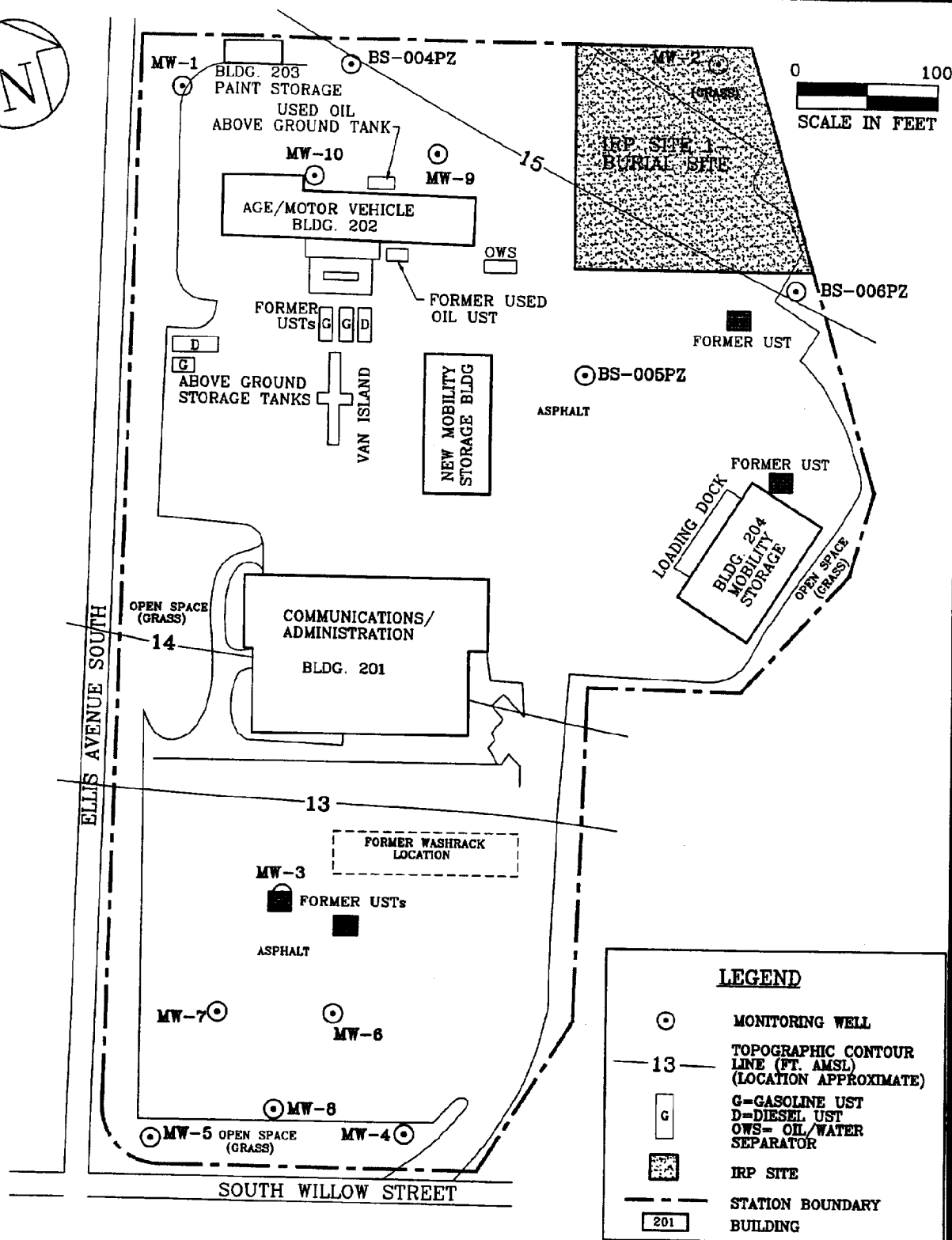
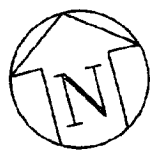
**2.1 Groundwater Sampling**

Groundwater samples were collected and water levels measured in the following monitoring wells: BS-004PZ, BS-005PZ, BS-006PZ, and MW-1 through MW-10. Upgradient wells BS-004PZ and MW-1 at the north end of the Station (Figure 2-1) are considered background wells.

Prior to the collection of groundwater samples, static water levels in the monitoring wells were measured to within  $\pm 0.01$  feet using an electronic water level indicator. Measurements were made from established reference points marked on top of each well casing. The monitoring wells were then purged and sampled using low-flow methods. Samples were collected for analysis of VOCs.

**2.1.1 Sample Collection Procedures**

Using a bladder pump, each monitoring well was purged at a rate of less than 500 milliliters per minute. The pump was placed between the middle and top of the screened interval in each well. The temperature, acidity/alkalinity (pH), specific conductance, turbidity, and dissolved oxygen content of the purge water were monitored during well purging using an in-line flow cell and portable water quality meter. Purging continued until specific conductance and turbidity (or dissolved oxygen) stabilized to within  $\pm 10$  percent, pH to within  $\pm 0.1$  units, and temperature to within  $\pm 1$  degree Celsius.



## GROUNDWATER MONITORING WELL LOCATIONS

143rd CCSQ, Seattle ANGS  
Seattle, Washington

FIGURE 2-1

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After each monitoring well was purged, groundwater samples were collected using the bladder pump. The samples were collected in 40-milliliter glass vials with Teflon-lined septum lids and preserved with hydrochloric acid. Immediately following sample collection, the groundwater samples were labeled and placed in coolers containing ice. The samples were delivered to the analytical laboratory under chain of custody.

A fresh length of disposable polyethylene pump-discharge tubing was used at each monitoring well. Reusable sampling equipment was decontaminated before and after use at each well. The electronic water level indicator and the pump housing were washed with an aqueous solution of Liqui-Nox (a laboratory-grade detergent) followed by a tap water rinse, a rinse with American Society for Testing and Materials (ASTM) Type II reagent-grade water, and a final spray rinse with isopropanol. The pump internals were decontaminated by pouring and agitating a Liqui-Nox solution through the pump, followed by tap water and ASTM Type II water. The ASTM Type II water was produced on site by running Station tap water through a portable filtration system.

### **2.1.2 Field QA/QC Sampling**

In addition to the primary groundwater samples collected from the site's 13 groundwater monitoring wells, several quality assurance/quality control (QA/QC) samples were submitted for analysis, as follows:

- One equipment rinsate blank and two field blanks were collected. ASTM Type II water was used to prepare the rinsate blank; field blanks were prepared from Station tap water and ASTM Type II water. The sample identifiers for the blank samples consisted of the identifier for the primary sample collected immediately prior to the blank, followed by an "R" for the rinsate blank, an "FT" for the tap water field blank, and an "FA" for the ASTM Type II water field blank.
- One duplicate sample was collected from monitoring well MW-8. The sample identifier for the field duplicate sample was the same as the associated primary sample, followed by a "D".
- Extra sample volume was collected from monitoring well MW-8 for matrix spike/matrix spike duplicate analysis.

### **2.1.3 Groundwater Sample Analyses**

The groundwater samples were analyzed for VOCs using United States Environmental Protection Agency (USEPA) Method 8260B. North Creek Analytical in Bothell, Washington performed the analyses. A summary of the samples submitted for laboratory analysis is shown in Table 2-1.

## **2.2 Investigation-Derived Waste Management**

Purge water and decontamination water was collected and stored in a 55-gallon drum. The groundwater analytical results were used to designate the drum contents as dangerous or non-dangerous waste in accordance with Washington State Dangerous Waste Regulations, Washington Administrative Code Chapter 173-303.

The purge water and decontamination water was determined not to be a Washington-defined dangerous waste. Accordingly, the purge water and decontamination water can be discharged to the sanitary sewer if approved by the local publicly owned treatment works (King County Department of Natural Resources, Wastewater Division). Alternatively, the purge water and decontamination water may be disposed at a facility that is permitted to receive and dispose of industrial wastewater, or at a permitted dangerous waste treatment, storage, and disposal facility.

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TABLE 2-1

*Summary of Groundwater Samples and Analytical Methods, May 2000  
143rd CCSQ, Seattle ANG, Seattle, Washington*

Matrix	Sampling Method/Locations	Field Parameters	Laboratory Parameters	Analytical Method	Primary Sample Analyses	QA/QC Samples				Total Laboratory Analyses
						Rinsate Blank	Field Blank	Field Duplicate	MS/MSD	
Groundwater	Low-flow sampling; 13 on-site monitoring wells	S.C., Turbidity, pH, Temperature, D.O.	VOCs	USEPA 8260B	13	1	2	1	1	18

**Notes:**

D.O. = Dissolved oxygen content  
MS/MSD = Matrix spike/matrix spike duplicate  
pH = Acidity/alkalinity  
QA/QC = Quality assurance/quality control

S.C. = Specific conductance  
USEPA = United States Environmental Protection Agency  
VOC = Volatile organic compound

## SECTION 3.0

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**RESULTS**

This section summarizes the results of the May 2000 groundwater sampling event at the Seattle ANGS.

**3.1 Groundwater Level Data Results**

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Static water levels measured in the monitoring wells on 30 May 2000 ranged from approximately 7 to 10 feet below ground surface. Depth measurements were converted to groundwater elevations by subtracting the measured depth to water in each well from the known elevation of the wellhead (top of well casing). A potentiometric surface map generated from the groundwater elevation data is presented in Figure 3-1. The inferred groundwater flow direction was toward the south-southwest, consistent with previous measurements. Cumulative water level data for the Seattle ANGS monitoring wells are included in Appendix A.

**3.2 Field Parameter Results**

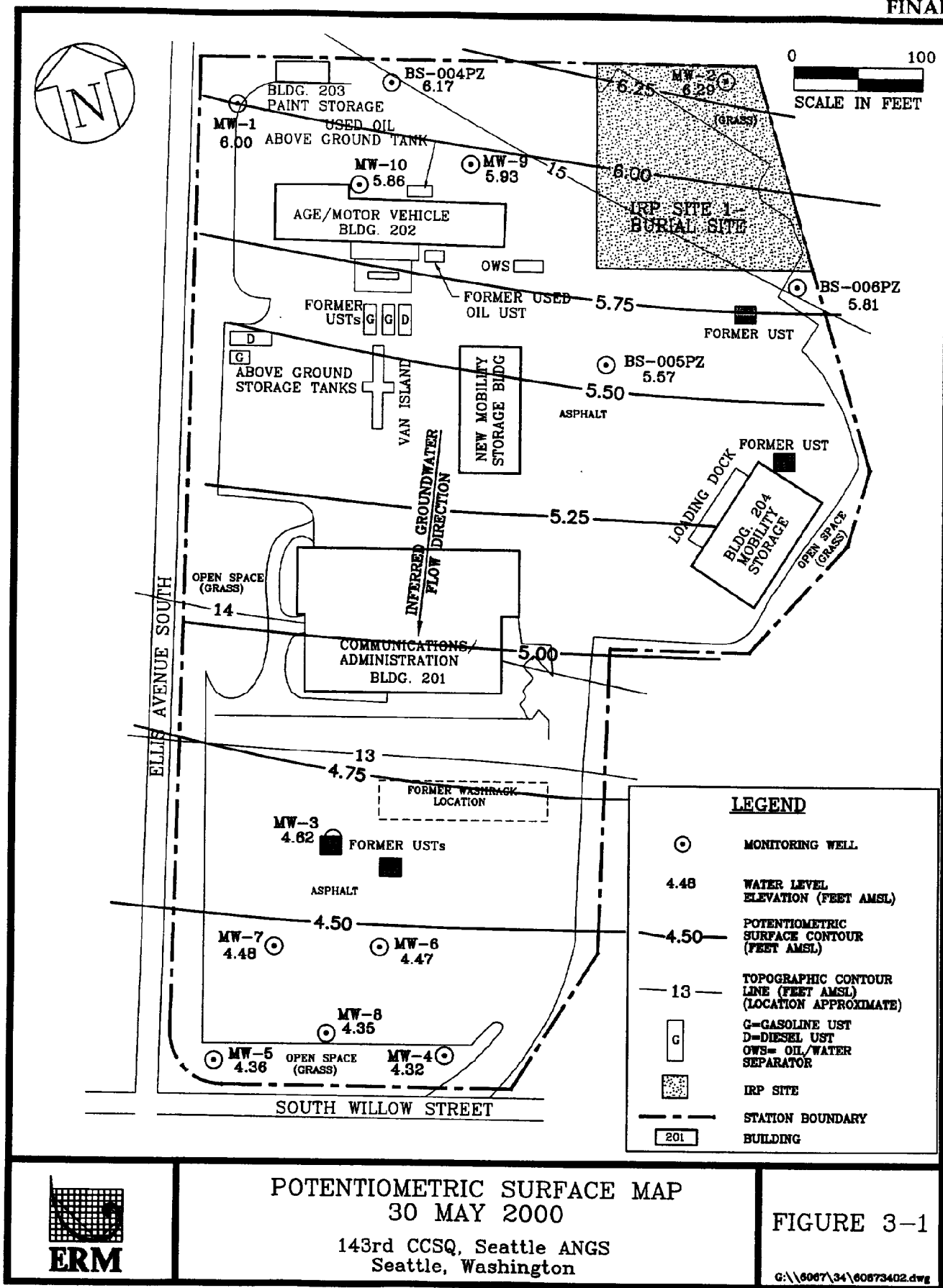
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Before each monitoring well was sampled, the well was purged until field parameter measurements stabilized. The final field parameter measurements are summarized in Table 3-1.

**3.3 Analytical Results**

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The analytical testing results for the May 2000 groundwater samples are summarized in Table 3-2. Table 3-2 also includes the results for groundwater samples collected during the RI and previous quarterly sampling events, and the PSGs derived from chemical-specific ARARs. Copies of the laboratory data summary sheets are included in Appendix B. The QC Data Validation Report is included in Appendix C. Appendix D contains copies of the Chain-of-Custody Forms.



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**TABLE 3-1**  
**Final Field Parameter Measurements During Monitoring Well Purging, May 2000**  
**143rd CCSQ, Seattle ANG, Seattle, Washington**

Monitoring Well	Field Parameters				
	Temperature (Degrees Celsius)	pH	Specific Conductance ( $\mu$ S/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/l)
BS-004PZ (Background Well)	13.6	6.10	21	36	6.08
BS-005PZ	13.6	6.26	33	60	3.65
BS-006PZ	13.0	6.37	35	240	4.21
MW-1 (Background Well)	14.1	6.45	25	89	3.34
MW-2	13.0	6.12	31	110	3.93
MW-3	15.0	6.30	49	45	3.45
MW-4	13.7	6.46	41	380	4.01
MW-5	12.5	6.37	40	92	2.66
MW-6	14.7	6.52	25	160	2.86
MW-7	14.1	6.34	53	270	3.43
MW-8	14.3	6.43	42	57	2.57
MW-9	13.6	6.18	29	38	7.36
MW-10	13.9	6.27	25	100	4.74

**Notes:**

pH = Acidity/alkalinity

$\mu$ S/cm = Microsiemens per centimeter

mg/l = Milligrams per liter

NTU = Nephelometric turbidity units

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TABLE 3-2  
Organic Constituents Detected in Groundwater Monitoring Wells  
143rd CCSQ, Seattle ANG, Seattle, Washington

Location	Date	Acetone	Chloroform	Toluene	Bromodichloro- methane	1,1- Dichloroethane	1,1,1- Trichloroethane	cis-1,2- Dichloroethane	1,3,5- Trimethylbenzene	Trichloroethene	Tetrachloroethene
BS-004PZ (Background Well)	9/17/96	ND	ND	(ND)	ND	0.3	3.7	ND	ND	ND	3.8
	9/17/96 (dup)	ND	ND	(ND)	ND	0.3	3.8	ND	ND	ND	3.8
	1/14/97	ND	ND	ND	ND	ND	2.4	ND	ND	ND	5.1
	4/11/97	ND	ND	ND	ND	ND	3.3	ND	ND	ND	17
	7/10/97	ND	ND	ND	ND	ND	1.8	ND	ND	ND	(ND)
	9/2/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	2.0
	11/25/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/19/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	6.8
	8/25/99	ND	(ND)	ND	(ND)	ND	ND	ND	NA	ND	ND
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	3.1
	2/23/00	ND	ND	ND	ND	ND	ND	ND	NA	ND	4.1
BS-005PZ	5/30/00	NA	NA	ND	ND	ND	ND	ND	NA	ND	3.55
	9/17/96	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND
	1/15/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/11/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/11/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.7
	9/1/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/25/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/18/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	8/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/00	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
BS-006PZ	5/31/00	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND
	9/17/96	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND
	1/14/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/11/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/11/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/2/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/18/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	8/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/23/00	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/31/00	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND

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TABLE 3-2  
Organic Constituents Detected in Groundwater Monitoring Wells  
143rd CCSQ, Seattle ANG, Seattle, Washington

Location	Date	Acetone	Chloroform	Toluene	Bromodichloro- methane	1,1- Dichloroethane	1,1,1- Trichloroethane	cis-1,2- Dichloroethene	1,3,5- Trimethylbenzene	Trichloroethene	Tetrachloroethene
MW-1 (Background Well)	10/18/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/17/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/14/97	ND	ND	1.1	ND	ND	ND	ND	ND	ND	ND
	4/11/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/11/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/1/98	ND	ND	6.0	ND	ND	ND	ND	NA	ND	ND
	11/25/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	5.2
	5/19/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	8/23/99	ND	(ND)	ND	(ND)	ND	ND	ND	NA	ND	ND
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/23/00	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/31/00	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND
MW-2	10/18/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/17/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/15/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/15/97 (dup)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/10/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/11/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/2/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/25/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/18/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	8/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/23/00	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/31/00	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND
MW-3	10/18/96	18	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/18/96 (dup)	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/17/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/17/96 (dup)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/15/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4/11/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	7/11/97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	9/2/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	9/2/98 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/98 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/25/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/18/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	8/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	1.2
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/23/00	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/30/00	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND



FINAL

TABLE 3-2  
Organic Constituents Detected in Groundwater Monitoring Wells  
143rd CCSQ, Seattle ANG, Seattle, Washington

Location	Date	Acetone	Chloroform	Toluene	Bromodichloro- methane	1,1- Dichloroethane	1,1,1- Trichloroethane	cis-1,2- Dichloroethane	1,3,5- Trimethylbenzene	Trichloroethene	Tetrachloroethene
MW-4	10/18/96	11	ND	ND	ND	ND	ND	ND	ND	3.9	ND
	12/17/96	ND	ND	ND	ND	ND	ND	ND	ND	2.7	ND
	1/14/97	ND	ND	ND	ND	ND	ND	ND	ND	3.4	ND
	4/11/97	ND	ND	ND	ND	ND	ND	ND	ND	3.2	ND
	7/11/97	ND	ND	ND	ND	ND	ND	ND	ND	2.8	ND
	9/2/98	ND	ND	ND	ND	ND	ND	ND	NA	2.0	ND
	11/24/98	ND	ND	ND	ND	ND	ND	ND	NA	3.4	ND
	2/24/99	ND	ND	ND	ND	ND	ND	ND	NA	2.6	ND
	2/24/99 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	2.6	ND
	5/18/99	ND	ND	ND	ND	ND	ND	ND	NA	2.9	ND
	8/24/99	ND	ND	ND	ND	ND	ND	ND	NA	3.3	ND
	11/24/99	ND	ND	ND	ND	ND	ND	ND	NA	2.4	ND
	2/24/00	ND	ND	ND	ND	ND	ND	ND	NA	2.9	ND
	5/30/00	NA	NA	ND	ND	ND	ND	ND	NA	4.99	ND
MW-5	10/18/96	ND	ND	ND	ND	ND	ND	5.6	ND	ND	ND
	12/17/96	ND	ND	ND	ND	ND	ND	4.9	ND	ND	ND
	1/14/97	ND	ND	ND	ND	ND	ND	2.7	ND	ND	ND
	4/11/97	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND
	4/11/97 (dup)	ND	ND	ND	ND	ND	ND	1.6	ND	ND	ND
	7/10/97	ND	ND	ND	ND	ND	ND	3.5	ND	2.1	(ND)
	7/10/97 (dup)	ND	ND	ND	ND	ND	ND	2.8	ND	ND	ND
	9/2/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/98	ND	ND	ND	ND	ND	ND	3.2	NA	ND	ND
	2/25/99	ND	ND	ND	ND	ND	ND	1.7	NA	ND	ND
	5/18/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	8/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/23/99	ND	ND	ND	ND	ND	ND	2.2	NA	ND	ND
	2/24/00	ND	ND	ND	ND	ND	ND	2.5	NA	ND	ND
	5/30/00	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND
MW-6	9/2/98	ND	ND	ND	ND	ND	ND	ND	NA	3.0	ND
	11/24/98	ND	ND	ND	ND	ND	ND	ND	NA	3.0	ND
	2/25/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/18/99	ND	ND	ND	ND	ND	ND	1.0	NA	5.7	ND
	8/24/99	ND	ND	ND	ND	ND	ND	ND	NA	3.5	ND
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	2.9	ND
	2/24/00	ND	ND	ND	ND	ND	ND	1.0	NA	4.3	ND
	5/30/00	NA	NA	ND	ND	ND	ND	ND	NA	2.66	ND

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TABLE 3-2  
Organic Constituents Detected in Groundwater Monitoring Wells  
143rd CCSQ, Seattle ANG, Seattle, Washington

Location	Date	Acetone	Chloroform	Toluene	Bromodichloro- methane	1,1- Dichloroethane	1,1,1- Trichloroethane	cis-1,2- Dichloroethene	1,3,5- Trimethylbenzene	Trichloroethene	Tetrachloroethene
MW-7	9/2/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/98	ND	ND	ND	ND	ND	ND	ND	NA	3.8	ND
	2/25/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/18/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	8/24/99	ND	ND	ND	ND	ND	ND	ND	NA	1.9	1.7
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	1.5	ND
	2/24/00	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/31/00	NA	NA	ND	ND	ND	ND	ND	NA	1.19	ND
MW-8	9/2/98	ND	ND	ND	ND	ND	ND	ND	NA	3.0	ND
	11/24/98	ND	ND	ND	ND	ND	ND	ND	NA	3.3	ND
	2/24/99	ND	ND	ND	ND	ND	ND	39	NA	83	ND
	2/24/99 (dup)	ND	ND	ND	ND	ND	ND	42	NA	87	ND
	5/18/99	ND	ND	ND	ND	ND	ND	4.5	NA	19	ND
	5/18/99 (dup)	ND	ND	ND	ND	ND	ND	4.7	NA	21	ND
	8/24/99	ND	ND	ND	ND	ND	ND	ND	NA	7.2	ND
	8/24/99 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	6.7	ND
	11/24/99	ND	ND	ND	ND	ND	ND	ND	NA	4.2	ND
	11/24/99 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	4.3	ND
	2/24/00	ND	ND	ND	ND	ND	ND	5.8	NA	12	ND
	2/24/00 (dup)	ND	ND	ND	ND	ND	ND	6.1	NA	14	ND
	5/30/00	NA	NA	ND	ND	ND	ND	1.29	NA	3.25	ND
	5/30/00 (dup)	NA	NA	ND	ND	ND	ND	1.12	NA	3.00	ND
MW-9	9/1/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/18/99	ND	ND	ND	ND	ND	1.4	ND	NA	ND	1.8
	8/24/99	ND	ND	ND	ND	ND	2.0	ND	NA	ND	1.9
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/00	ND	ND	ND	ND	ND	1.2	ND	NA	ND	ND
	5/30/00	NA	NA	ND	ND	ND	1.25	ND	NA	ND	1.22

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# FINAL

TABLE 3-2  
Organic Constituents Detected in Groundwater Monitoring Wells  
143rd CCSQ, Seattle ANG, Seattle, Washington

Location	Date	Acetone	Chloroform	Toluene	Bromodichloro- methane	1,1- Dichloroethane	1,1,1- Trichloroethane	cis-1,2- Dichloroethane	1,3,5- Trimethylbenzene	Trichloroethene	Tetrachloroethene
MW-10	9/1/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/25/98	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/19/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	8/25/99	ND	(ND)	ND	(ND)	ND	ND	ND	NA	ND	ND
	11/23/99	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	2/24/00	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	5/30/00	NA	NA	ND	ND	ND	ND	ND	NA	ND	ND
RI Project Screening Goal		800	-	40	-	800	200	70	0.507	5.0	5.0

## Notes:

All concentrations in micrograms per liter (µg/l)

ND = Not detected above laboratory method reporting limit

(ND) = A positive detection was reported by the laboratory for this constituent in the sample indicated. The sample result was qualified as "not detected" based on a detection of the constituent in an associated quality control blank (United States Environmental Protection Agency Contract Laboratory Program "10x" and "5x" rules).

NA = Not analyzed

dup = Duplicate sample

RI = Remedial Investigation

Shaded cell/bold typeface indicates a value exceeding the associated RI project screening goal.

- = RI project screening goal not established

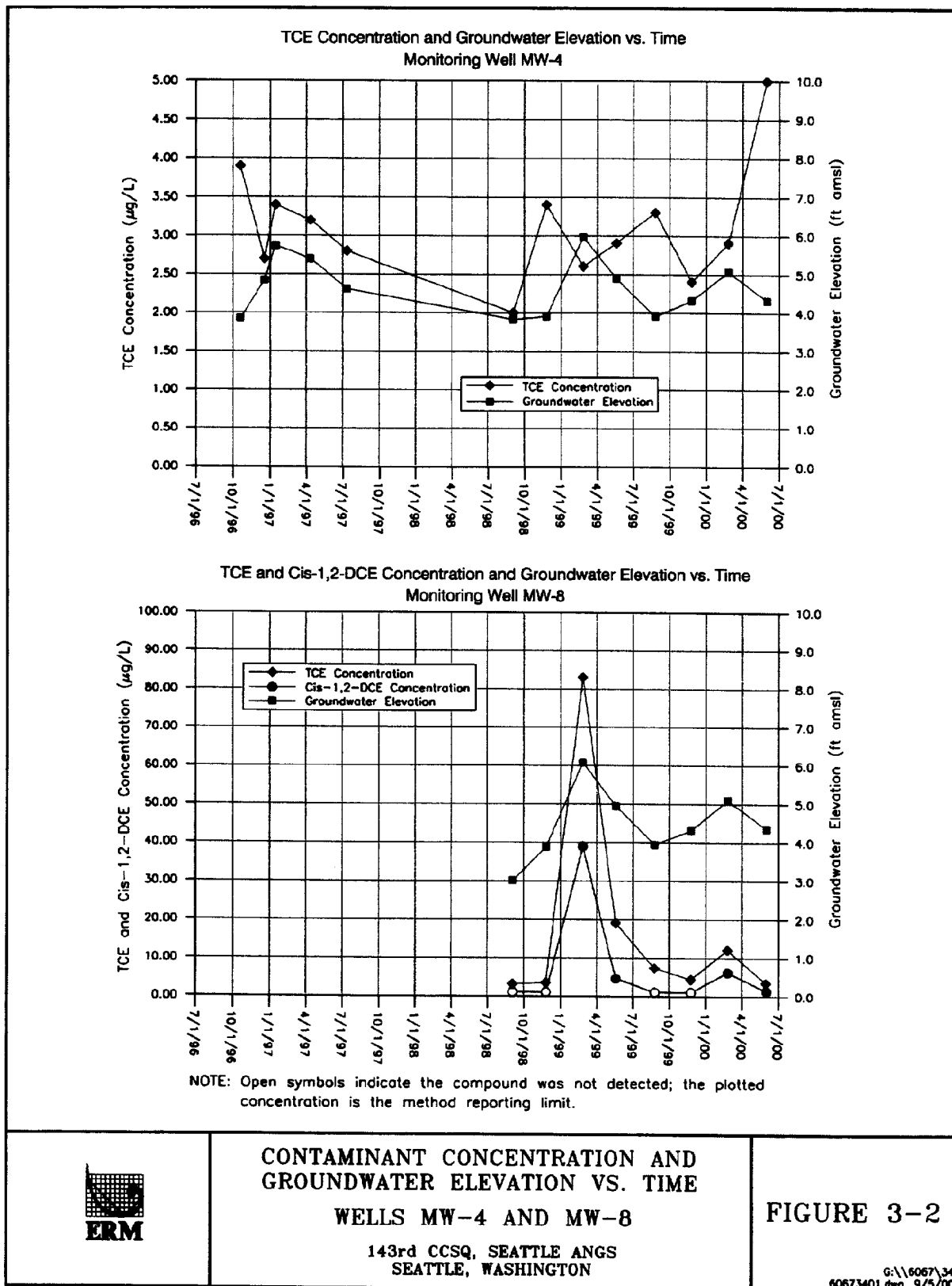
### **3.3.1 Groundwater Samples**

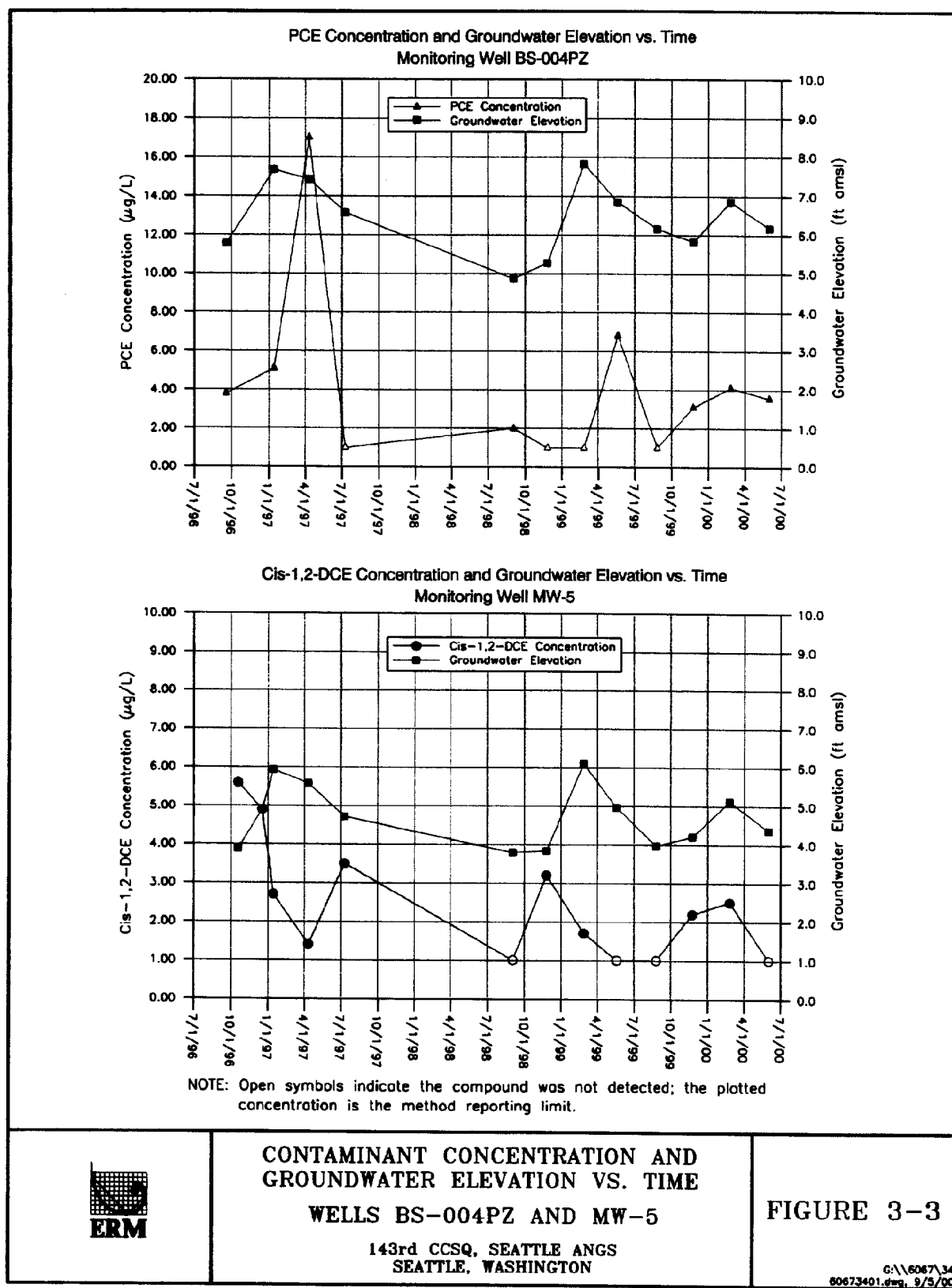
Chlorinated VOCs were detected below PSGs in the groundwater samples collected from six monitoring wells. Detected compounds include PCE in wells BS-004PZ and MW-9 (1.22 to 3.55  $\mu\text{g/l}$ ), TCE in wells MW-4, MW-6, MW-7, and MW-8 (1.19 to 4.99  $\mu\text{g/l}$ ), cis-1,2-dichloroethene (cis-1,2-DCE) in well MW-8 (1.29  $\mu\text{g/l}$ ), and 1,1,1-trichloroethane in well MW-9 (1.25  $\mu\text{g/l}$ ).

Time-series plots of groundwater elevation versus TCE, PCE, and cis-1,2-DCE concentrations were produced for wells BS-004PZ, MW-4, MW-5, and MW-8 to determine whether measured contaminant concentrations correlate with groundwater fluctuations beneath the Station. The time-series plots are shown in Figures 3-2 and 3-3. Portions of the data for wells MW-4 and MW-8 indicate an apparent correlation between contaminant concentrations and groundwater elevation (Figure 3-2). The data for wells MW-5 and BS-004PZ also suggest a possible correlation between contaminant concentrations and groundwater elevation, although the evidence is not as strong.

### **3.3.2 Field QC Blank Samples**

Field QC blank samples were analyzed for the same parameters as the associated groundwater samples. No contaminants were detected in the field QC blank samples.





## SECTION 4.0

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*CONCLUSIONS*

Groundwater samples collected at the Seattle ANG S in May 2000 were analyzed for VOCs. The chlorinated compounds PCE, TCE, cis-1,2-DCE, and 1,1,1-trichloroethane were detected below Washington State MTCA Method A Cleanup Levels in select monitoring wells near the northern and southern Station boundaries.

Time-series plots of contaminant concentrations versus groundwater elevation were produced for monitoring wells BS-004PZ, MW-4, MW-5, and MW-8. Portions of the data for wells MW-4 and MW-8 indicate an apparent correlation between dissolved contaminant concentrations and temporal water table fluctuations. This correlation is less apparent in wells MW-5 and BS-004PZ.

The source of the chlorinated VOCs detected in groundwater has not been identified. Observed TCE concentrations in monitoring wells MW-4 and MW-8 appear to depend in part on groundwater elevation, which suggests that there may be a residual contaminant source (e.g., sorbed-phase VOCs) in soils near the water table proximal to these wells. As discussed in the Phase II RI Report (ERM 1999a), the TCE detected in monitoring wells in the southern portion of the Station may be related to the dissolved TCE plume beneath the Boeing Area 3-360 facility immediately south of the Seattle ANG S.

## SECTION 5.0

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### REFERENCES

Environmental Resources Management (ERM). 1999a. *Installation Restoration Program Final Phase II Remedial Investigation Report, 143rd Combat Communications Squadron, Seattle Air National Guard Station*. August 1999.

\_\_\_\_\_. 1999b. *Installation Restoration Program Final Phase II Feasibility Study Report, 143rd Combat Communications Squadron, Seattle Air National Guard Station*. August 1999.

\_\_\_\_\_. 1999c. *Installation Restoration Program Final 1999-2000 Groundwater Monitoring Work Plan, 143rd Combat Communications Squadron, Seattle Air National Guard Station*. September 1999.



## Appendix A

KCSlip4 42845

SEA409375

**APPENDIX A**

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***WATER LEVEL DATA***

**TABLE A-1**  
**Monitoring Well Water Level Summary**  
**143rd CCSQ, Seattle ANG, Seattle, Washington**

Monitoring Well	Measuring Point Elevation (ft amsl)	Date	Depth to Water (ft bmp)	Water Level Elevation (ft amsl)
BS-004PZ (Background Well)	14.66	9/17/96	8.88	5.78
		10/22/96	8.93	5.73
		12/17/96	8.08	6.58
		1/14/97	6.98	7.68
		4/11/97	7.23	7.43
		7/10/97	8.08	6.58
		9/1/98	9.79	4.87
		11/24/98	9.39	5.27
		02/24/99	6.84	7.82
		05/18/99	7.81	6.85
		08/25/99	8.50	6.16
		11/23/99	8.84	5.82
		02/23/00	7.80	6.86
		05/30/00	8.49	6.17
BS-005PZ	14.39	9/17/96	9.16	5.23
		10/22/96	9.42	4.97
		12/17/96	8.51	5.88
		1/15/97	7.48	6.91
		4/10/97	7.65	6.74
		7/11/97	8.47	5.92
		9/1/98	10.12	4.27
		11/24/98	9.41	4.98
		02/24/99	7.32	7.07
		05/18/99	8.15	6.24
		08/24/99	9.19	5.20
		11/23/99	9.13	5.26
		02/23/00	8.16	6.23
		05/30/00	8.82	5.57
BS-006PZ	14.59	9/17/96	9.12	5.47
		10/22/96	9.47	5.12
		12/17/96	8.54	6.05
		1/14/97	7.62	6.97
		4/11/97	7.77	6.82
		7/11/97	8.49	6.10
		9/1/98	10.29	4.30
		11/24/98	9.37	5.22
		02/24/99	7.42	7.17
		05/28/99	8.20	6.39
		08/24/99	9.16	5.43
		11/23/99	9.10	5.49
		02/23/00	8.18	6.41
		05/30/00	8.78	5.81

TABLE A-1

*Monitoring Well Water Level Summary  
143rd CCSQ, Seattle ANG, Seattle, Washington*

Monitoring Well	Measuring Point Elevation (ft amsl)	Date	Depth to Water (ft bmp)	Water Level Elevation (ft amsl)
MW-1 (Background Well)	14.92	10/22/96	9.18	5.74
		12/17/96	8.20	6.72
		1/14/97	7.11	7.81
		4/10/97	7.58	7.34
		7/11/97	8.51	6.41
		9/1/98	10.22	4.70
		11/24/98	9.45	5.47
		02/24/99	7.12	7.80
		05/18/99	8.25	6.67
		08/25/99	8.78	6.14
		11/23/99	9.23	5.69
		02/23/00	8.18	6.74
		05/30/00	8.92	6.00
MW-2	14.60	10/22/96	8.89	5.71
		12/17/96	8.03	6.57
		1/15/97	7.13	7.47
		4/10/97	7.25	7.35
		7/11/97	7.98	6.62
		9/1/98	9.59	5.01
		11/24/98	9.75	4.85
		02/24/99	6.70	7.90
		05/18/99	7.71	6.89
		08/24/99	8.68	5.92
		11/23/99	8.67	5.93
		02/23/00	7.68	6.92
		05/30/00	8.31	6.29
MW-3	11.88	10/22/96	7.77	4.11
		12/17/96	6.78	5.10
		1/15/97	7.80	4.08
		4/11/97	6.06	5.82
		7/11/97	6.94	4.94
		9/1/98	8.09	3.79
		11/24/98	7.20	4.68
		02/24/99	5.56	6.32
		05/18/99	6.65	5.23
		08/24/99	7.05	4.83
		11/23/99	7.43	4.45
		02/23/00	6.52	5.36
		05/30/00	7.26	4.62

TABLE A-1

**Monitoring Well Water Level Summary**  
**143rd CCSQ, Seattle ANG, Seattle, Washington**

Monitoring Well	Measuring Point Elevation (ft amsl)	Date	Depth to Water (ft bmp)	Water Level Elevation (ft amsl)
MW-4	12.05	10/22/96	8.20	3.85
		12/17/96	7.21	4.84
		1/14/97	6.31	5.74
		4/11/97	6.65	5.40
		7/11/97	7.43	4.62
		9/1/98	8.21	3.84
		11/24/98	8.14	3.91
		02/24/99	6.08	5.97
		05/18/99	7.16	4.89
		08/24/99	8.14	3.91
		11/24/99	7.73	4.32
		02/23/00	6.98	5.07
		05/30/00	7.73	4.32
MW-5	13.94	10/22/96	10.06	3.88
		12/17/96	9.06	4.88
		1/14/97	8.01	5.93
		4/11/97	8.36	5.58
		7/10/97	9.23	4.71
		9/1/98	10.15	3.79
		11/24/98	10.11	3.83
		02/24/99	7.84	6.10
		05/18/99	8.98	4.96
		08/24/99	9.97	3.97
		11/23/99	9.74	4.20
		02/23/00	8.82	5.12
		05/30/00	9.58	4.36
MW-6	11.62	9/1/98	8.38	3.24
		11/24/98	7.64	3.98
		02/24/99	5.50	6.12
		05/18/99	6.55	5.07
		08/24/99	7.54	4.08
		11/23/99	7.28	4.34
		02/23/00	6.40	5.22
		05/30/00	7.15	4.47
MW-7	12.17	9/1/98	6.75	5.42
		11/24/98	7.30	4.87
		02/24/99	5.94	6.23
		05/18/99	7.05	5.12
		08/24/99	8.08	4.09
		11/23/99	7.85	4.32
		02/23/00	6.94	5.23
		05/30/00	7.69	4.48

TABLE A-1

**Monitoring Well Water Level Summary**  
**143rd CCSQ, Seattle ANG, Seattle, Washington**

Monitoring Well	Measuring Point Elevation (ft amsl)	Date	Depth to Water (ft bmp)	Water Level Elevation (ft amsl)
MW-8	11.90	9/1/98	8.89	3.01
		11/24/98	8.02	3.88
		02/24/99	5.82	6.08
		05/18/99	6.95	4.95
		08/24/99	7.95	3.95
		11/24/99	7.59	4.31
		02/23/00	6.80	5.10
		05/30/00	7.55	4.35
MW-9	14.30	9/1/98	9.78	4.52
		11/24/98	8.00	6.30
		02/24/99	6.76	7.54
		05/18/99	7.69	6.61
		08/24/99	8.42	5.88
		11/23/99	8.43	5.87
		02/23/00	7.70	6.60
		05/30/00	8.37	5.93
MW-10	14.97	9/1/98	10.42	4.55
		11/24/98	9.69	5.28
		02/24/99	7.40	7.57
		05/18/99	8.43	6.54
		08/25/99	9.00	5.97
		11/23/99	9.45	5.52
		02/23/00	8.40	6.57
		05/30/00	9.11	5.86

**Notes:**

ft amsl = Feet above mean sea level

ft bmp = Feet below measuring point

**Appendix B**

**FINAL**

**APPENDIX B**

---

***LABORATORY DATA SUMMARY SHEETS***





Seattle 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8223  
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Spokane East 11115 Montgomery, Suite B, Spokane, WA 99206-4776  
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503.906.9200 fax 503.906.9210  
Bond 20332 Empire Avenue, Suite F-1, Bond, OR 97701-5711  
541.383.9310 fax 541.382.7588

ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW-4-99/00-4FA	BOF0026-01	Water	05/30/00 15:10	06/01/00 17:30
MW-4-99/00-4	BOF0026-02	Water	05/30/00 15:25	06/01/00 17:30
BS-004PZ-99/00-4	BOF0026-03	Water	05/30/00 13:00	06/01/00 17:30
MW-9-99/00-4	BOF0026-04	Water	05/30/00 12:00	06/01/00 17:30
MW-3-99/00-4	BOF0026-05	Water	05/30/00 13:40	06/01/00 17:30
MW-6-99/00-4	BOF0026-06	Water	05/30/00 14:15	06/01/00 17:30
MW-5-99/00-4	BOF0026-07	Water	05/30/00 14:50	06/01/00 17:30
MW-8-99/00-4	BOF0026-08	Water	05/30/00 15:55	06/01/00 17:30
MW-8-99/00-4D	BOF0026-09	Water	05/30/00 15:55	06/01/00 17:30
MW-8-99/00-4R	BOF0026-10	Water	05/30/00 16:15	06/01/00 17:30
MW-10-99/00-4	BOF0026-11	Water	05/30/00 11:20	06/01/00 17:30
MW-4-99/00-4FT	BOF0026-12	Water	05/30/00 15:20	06/01/00 17:30
N-2-99/00-4	BOF0026-13	Water	05/31/00 10:08	06/01/00 17:30
BS-006PZ-99/00-4	BOF0026-14	Water	05/31/00 11:19	06/01/00 17:30
BS-005PZ-99/00-4	BOF0026-15	Water	05/31/00 12:07	06/01/00 17:30
MW-7-99/00-4	BOF0026-16	Water	05/31/00 13:16	06/01/00 17:30
MW-1-99/00-4	BOF0026-17	Water	05/31/00 14:12	06/01/00 17:30

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

*Laura Gendron*

Laura Gendron, Project Manager

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Environmental Laboratory Network

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Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
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MW-4-99/00-4FA (B0F0026-01) Water Sampled: 05/30/00 15:10 Received: 06/01/00 17:30

Benzene	ND	1.00	ug/l	1	OF06013	06/05/00	06/09/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	

Surrogate: 1,2-DCA-d4 87.3 % 80-120

Surrogate: Toluene-d8 96.5 % 80-120

Surrogate: 4-BFB 103 % 80-120

MW-4-99/00-4 (B0F0026-02) Water Sampled: 05/30/00 15:25 Received: 06/01/00 17:30

Benzene	ND	1.00	ug/l	1	OF06013	06/05/00	06/09/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain custody document. This analytical report must be reproduced in its entirety.

*Kura Cacka*

K Gendron, Project Manager

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Environmental Laboratory Network

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KCSlip4 42854

SEA409384



Seattle 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8223  
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541.383.9310 fax 541.382.7588

ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>MW-4-99/00-4 (B0F0026-02) Water</b> Sampled: 05/30/00 15:25 Received: 06/01/00 17:30									
Tetrachloroethene	ND	1.00	ug/l	1	0F06013	06/05/00	06/09/00	EPA 8260B	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	4.99	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	93.5 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	97.0 %	80-120			"	"	"	"	
Surrogate: 4-BFB	102 %	80-120			"	"	"	"	
<b>BS-004PZ-99/00-4 (B0F0026-03) Water</b> Sampled: 05/30/00 13:00 Received: 06/01/00 17:30									
Benzene	ND	1.00	ug/l	1	0F06013	06/05/00	06/08/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	3.55	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	98.0 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	97.5 %	80-120			"	"	"	"	
Surrogate: 4-BFB	102 %	80-120			"	"	"	"	

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

*Laura Calkins*

Kirk Gendron, Project Manager

North Creek Analytical, Inc.  
Environmental Laboratory Network

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KCSlip4 42855

SEA409385



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ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
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MW-9-99/00-4 (B0F0026-04) Water Sampled: 05/30/00 12:00 Received: 06/01/00 17:30

Benzene	ND	1.00	ug/l	1	0F06013	06/05/00	06/09/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	1.22	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	1.25	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	

Surrogate: 1,2-DCA-d4 97.0 % 80-120

Surrogate: Toluene-d8 98.0 % 80-120

Surrogate: 4-BFB 101 % 80-120

MW-3-99/00-4 (B0F0026-05) Water Sampled: 05/30/00 13:40 Received: 06/01/00 17:30

Benzene	ND	1.00	ug/l	1	0F06013	06/05/00	06/09/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

*Laura Cack*

Kirk Gendron, Project Manager

North Creek Analytical, Inc.  
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KCSlip4 42856

SEA409386



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541.383.9310 fax 541.382.7588

ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANG5  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>MW-3-99/00-4 (B0F0026-05) Water</b> Sampled: 05/30/00 13:40 Received: 06/01/00 17:30									
Tetrachloroethene	ND	1.00	ug/l	1	0F06013	06/05/00	06/09/00	EPA 8260B	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	96.8 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	97.3 %	80-120			"	"	"	"	
Surrogate: 4-BFB	101 %	80-120			"	"	"	"	
<b>MW-6-99/00-4 (B0F0026-06) Water</b> Sampled: 05/30/00 14:15 Received: 06/01/00 17:30									
Benzene	ND	1.00	ug/l	1	0F06013	06/05/00	06/09/00	EPA 8260B	
1,1-Dichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	2.66	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	96.3 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	97.0 %	80-120			"	"	"	"	
Surrogate: 4-BFB	102 %	80-120			"	"	"	"	

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

*Laura Cockburn*

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Kirk Gendron, Project Manager

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KCSlip4 42857

SEA409387



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ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-5-99/00-4 (B0F0026-07) Water Sampled: 05/30/00 14:50 Received: 06/01/00 17:30									
Benzene	ND	1.00	ug/l	1	0F06013	06/05/00	06/09/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	97.7 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	97.3 %	80-120			"	"	"	"	
Surrogate: 4-BFB	103 %	80-120			"	"	"	"	
MW-8-99/00-4 (B0F0026-08) Water Sampled: 05/30/00 15:55 Received: 06/01/00 17:30									
Benzene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	1.29	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Bothell

The results in this report apply to the samples analyzed in accordance with the chain custody document. This analytical report must be reproduced in its entirety.

*Laura Cack Fu*

Lark Gendron, Project Manager

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North Creek Analytical, Inc.  
Environmental Laboratory Network

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KCSlip4 42858

SEA409388



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425.420.9200 fax 425.420.9210  
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503.906.9200 fax 503.906.9210  
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541.383.9310 fax 541.382.7588

ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>MW-8-99/00-4 (B0F0026-08) Water Sampled: 05/30/00 15:55 Received: 06/01/00 17:30</b>									
Tetrachloroethene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	3.25	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	98.0 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	95.0 %	80-120			"	"	"	"	
Surrogate: 4-BFB	104 %	80-120			"	"	"	"	
<b>MW-8-99/00-4D (B0F0026-09) Water Sampled: 05/30/00 15:55 Received: 06/01/00 17:30</b>									
Benzene	ND	1.00	ug/l	1	0F06013	06/05/00	06/09/00	EPA 8260B	
1,1-Dichloromethane	ND	1.00	"	"	"	"	"	"	
o-Toluenes	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	1.12	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	3.00	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	97.0 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	97.7 %	80-120			"	"	"	"	
Surrogate: 4-BFB	102 %	80-120			"	"	"	"	

North Creek Analytical - Bothell

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Kirk Gendron, Project Manager

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KCSlip4 42859

SEA409389



Seattle 11720 North Creek Pkwy N, Suite 400, Bothell, WA 98011-8223  
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541.383.9310 fax 541.382.7588

ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-8-99/00-4R (B0F0026-10) Water Sampled: 05/30/00 16:15 Received: 06/01/00 17:30									
Benzene	ND	1.00	ug/l	1	0F06013	06/05/00	06/09/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	

Surrogate: 1,2-DCA-d4	79.5 %	80-120	"	"	"	"	"	"	S-03
Surrogate: Toluene-d8	96.0 %	80-120	"	"	"	"	"	"	
Surrogate: 4-BFB	100 %	80-120	"	"	"	"	"	"	

MW-10-99/00-4 (B0F0026-11) Water Sampled: 05/30/00 11:20 Received: 06/01/00 17:30									
Benzene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Bothell

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*Laura Gendron*

Kirk Gendron, Project Manager

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KCSlip4 42860

SEA409390





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541.383.9310 fax 541.382.7588

ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>MW-10-99/00-4 (B0F0026-11) Water Sampled: 05/30/00 11:20 Received: 06/01/00 17:30</b>									
Tetrachloroethene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	97.0 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	96.8 %	80-120			"	"	"	"	
Surrogate: 4-BFB	101 %	80-120			"	"	"	"	
<b>MW-4-99/00-4FT (B0F0026-12) Water Sampled: 05/30/00 15:20 Received: 06/01/00 17:30</b>									
Benzene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
1,1-Dichloromethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	99.0 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	94.8 %	80-120			"	"	"	"	
Surrogate: 4-BFB	103 %	80-120			"	"	"	"	

North Creek Analytical - Bothell

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*Laura Cacka*

Kirk Gendron, Project Manager

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541.383.9310 fax 541.382.7588

ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANG5  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-2-99/00-4 (B0F0026-13) Water Sampled: 05/31/00 10:08 Received: 06/01/00 17:30									
Benzene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	99.0 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	94.3 %	80-120			"	"	"	"	
Surrogate: 4-BFB	103 %	80-120			"	"	"	"	

**BS-006PZ-99/00-4 (B0F0026-14) Water Sampled: 05/31/00 11:19 Received: 06/01/00 17:30**

Benzene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Bothell

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*Laura Gendron*

Kirk Gendron, Project Manager

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Environmental Laboratory Network

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KCSlip4 42862

SEA409392



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541.383.9310 fax 541.382.7588

ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANG5  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
BS-006PZ-99/00-4 (B0F0026-14) Water Sampled: 05/31/00 11:19 Received: 06/01/00 17:30									
Tetrachloroethene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	98.8 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	93.8 %	80-120			"	"	"	"	
Surrogate: 4-BFB	103 %	80-120			"	"	"	"	
BS-005PZ-99/00-4 (B0F0026-15) Water Sampled: 05/31/00 12:07 Received: 06/01/00 17:30									
Benzene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
o-benzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	90.7 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	96.8 %	80-120			"	"	"	"	
Surrogate: 4-BFB	101 %	80-120			"	"	"	"	

North Creek Analytical - Bothell

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Kirk Gendron, Project Manager

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KCSlip4 42863

SEA409393



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541.383.9310 fax 541.382.7588

ERM-Bellevue  
915-118th Avenue S.E., Suite 130  
Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-7-99/00-4 (B0F0026-16) Water Sampled: 05/31/00 13:16 Received: 06/01/00 17:30									
Benzene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	
Tetrachloroethene	ND	1.00	"	"	"	"	"	"	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	1.19	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylene	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	93.5 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	97.7 %	80-120			"	"	"	"	
Surrogate: 4-BFB	101 %	80-120			"	"	"	"	

**MW-1-99/00-4 (B0F0026-17) Water Sampled: 05/31/00 14:12 Received: 06/01/00 17:30**

Benzene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Bromodichloromethane	ND	1.00	"	"	"	"	"	"	
Chlorobenzene	ND	1.00	"	"	"	"	"	"	
Chloroethane	ND	1.00	"	"	"	"	"	"	
Chloromethane	ND	5.00	"	"	"	"	"	"	
1,1-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,2-Dichloroethane	ND	1.00	"	"	"	"	"	"	
1,1-Dichloroethene	ND	1.00	"	"	"	"	"	"	
cis-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
trans-1,2-Dichloroethene	ND	1.00	"	"	"	"	"	"	
1,2-Dichloropropane	ND	1.00	"	"	"	"	"	"	
Ethylbenzene	ND	1.00	"	"	"	"	"	"	
Methylene chloride	ND	5.00	"	"	"	"	"	"	

North Creek Analytical - Bothell

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*Laura Cacka*

Kirk Gendron, Project Manager

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KCSlip4 42864

SEA409394



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ERM-Bellevue  
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Bellevue WA, 98005

Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
MW-1-99/00-4 (B0F0026-17) Water Sampled: 05/31/00 14:12 Received: 06/01/00 17:30									
Tetrachloroethene	ND	1.00	ug/l	1	0F07022	06/07/00	06/08/00	EPA 8260B	
Toluene	ND	1.00	"	"	"	"	"	"	
1,1,1-Trichloroethane	ND	1.00	"	"	"	"	"	"	
Trichloroethene	ND	1.00	"	"	"	"	"	"	
Vinyl chloride	ND	1.00	"	"	"	"	"	"	
m,p-Xylenc	ND	1.00	"	"	"	"	"	"	
o-Xylene	ND	1.00	"	"	"	"	"	"	
Surrogate: 1,2-DCA-d4	95.2 %	80-120			"	"	"	"	
Surrogate: Toluene-d8	97.5 %	80-120			"	"	"	"	
Surrogate: 4-BFB	101 %	80-120			"	"	"	"	

North Creek Analytical - Bothell

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*Laura Gendron*

Kirk Gendron, Project Manager

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ERM-Bellevue  
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Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B - Quality Control**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC Limits	RPD	RPD Limit	Notes
---------	--------	--------------------	-------	----------------	------------------	----------------	-----	--------------	-------

Batch 0F06013: Prepared 06/05/00 Using EPA 5030B [P/T]

**Blank (0F06013-BLK1)**

Benzene	ND	1.00	ug/l						
Bromodichloromethane	ND	1.00	"						
Chlorobenzene	ND	1.00	"						
Chloroethane	ND	1.00	"						
Chloromethane	ND	5.00	"						
1,1-Dichloroethane	ND	1.00	"						
1,2-Dichloroethane	ND	1.00	"						
1,1-Dichloroethene	ND	1.00	"						
cis-1,2-Dichloroethene	ND	1.00	"						
trans-1,2-Dichloroethene	ND	1.00	"						
1,2-Dichloropropane	ND	1.00	"						
Ethylbenzene	ND	1.00	"						
Methylene chloride	5.23	5.00	"						
Tetrachloroethene	ND	1.00	"						
Toluene	ND	1.00	"						
1,1,1-Trichloroethane	ND	1.00	"						
Trichloroethene	ND	1.00	"						
Vinyl chloride	ND	1.00	"						
m,p-Xylene	ND	1.00	"						
o-Xylene	ND	1.00	"						
Surrogate: 1,2-DCA-d4	38.8		"	40.0		97.0	80-120		
Surrogate: Toluene-d8	39.0		"	40.0		97.5	80-120		
Surrogate: 4-BFB	40.8		"	40.0		102	80-120		

**LCS (0F06013-BS1)**

Benzene	20.0	1.00	ug/l	20.0		100	80-120		
Chlorobenzene	20.1	1.00	"	20.0		101	80-120		
1,1-Dichloroethene	19.4	1.00	"	20.0		97.0	80-120		
Toluene	20.1	1.00	"	20.0		101	80-120		
Trichloroethene	18.6	1.00	"	20.0		93.0	80-120		
Surrogate: 1,2-DCA-d4	39.6		"	40.0		99.0	80-120		
Surrogate: Toluene-d8	39.0		"	40.0		97.5	80-120		
Surrogate: 4-BFB	38.4		"	40.0		96.0	80-120		

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*Laura Cacchella*

Kirk Gendron, Project Manager

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ERM-Bellevue  
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Project: Seattle ANG5  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B - Quality Control**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
---------	--------	-----------------	-------	-------------	---------------	------	-------------	-----	-----------	-------

Batch 0F06013: Prepared 06/05/00 Using EPA 5030B [P/T]

**Matrix Spike (0F06013-MS1)**

Source: B0E0507-05

Benzene	19.7	1.00	ug/l	20.0	ND	98.5	80-120			
Chlorobenzene	18.8	1.00	"	20.0	ND	94.0	80-120			
1,1-Dichloroethene	18.8	1.00	"	20.0	ND	94.0	80-120			
Toluene	19.0	1.00	"	20.0	ND	95.0	80-120			
Trichloroethene	17.6	1.00	"	20.0	ND	88.0	80-120			
Surrogate: 1,2-DCA-d4	38.7		"	40.0		96.8	80-120			
Surrogate: Toluene-d8	38.8		"	40.0		97.0	80-120			
Surrogate: 4-BFB	41.0		"	40.0		103	80-120			

**Matrix Spike Dup (0F06013-MSD1)**

Source: B0E0507-05

Benzene	19.6	1.00	ug/l	20.0	ND	98.0	80-120	0.509	15	
Chlorobenzene	18.7	1.00	"	20.0	ND	93.5	80-120	0.533	15	
Dichloroethene	18.6	1.00	"	20.0	ND	93.0	80-120	1.07	15	
Toluene	18.9	1.00	"	20.0	ND	94.5	80-120	0.528	15	
Trichloroethene	17.6	1.00	"	20.0	ND	88.0	80-120	0	15	
Surrogate: 1,2-DCA-d4	39.0		"	40.0		97.5	80-120			
Surrogate: Toluene-d8	38.8		"	40.0		97.0	80-120			
Surrogate: 4-BFB	41.1		"	40.0		103	80-120			

Batch 0F07022: Prepared 06/07/00 Using EPA 5030B [P/T]

**Blank (0F07022-BLK1)**

Benzene	ND	1.00	ug/l							
Bromodichloromethane	ND	1.00	"							
Chlorobenzene	ND	1.00	"							
Chloroethane	ND	1.00	"							
Chloromethane	ND	5.00	"							
1,1-Dichloroethane	ND	1.00	"							
1,2-Dichloroethane	ND	1.00	"							
1,1-Dichloroethene	ND	1.00	"							
cis-1,2-Dichloroethene	ND	1.00	"							
trans-1,2-Dichloroethene	ND	1.00	"							
1,2-Dichloropropane	ND	1.00	"							
Ethylbenzene	ND	1.00	"							
Methylene chloride	ND	5.00	"							
Tetrachloroethene	ND	1.00	"							

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*Lauren Caccheta*

Kirk Gendron, Project Manager

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ERM-Bellevue  
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Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B - Quality Control**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC Limits	RPD	RPD Limit	Notes
<b>Batch 0F07022: Prepared 06/07/00 Using EPA 5030B [P/T]</b>									
<b>Blank (0F07022-BLK1)</b>									
Toluene	ND	1.00	ug/l						
1,1,1-Trichloroethane	ND	1.00	"						
Trichloroethene	ND	1.00	"						
Vinyl chloride	ND	1.00	"						
m,p-Xylene	ND	1.00	"						
o-Xylene	ND	1.00	"						
Surrogate: 1,2-DCA-d4	38.8		"	40.0		97.0	80-120		
Surrogate: Toluene-d8	37.9		"	40.0		94.8	80-120		
Surrogate: 4-BFB	41.7		"	40.0		104	80-120		
<b>LCS (0F07022-BS1)</b>									
Benzene	21.2	1.00	ug/l	20.0		106	80-120		
Chlorobenzene	20.1	1.00	"	20.0		101	80-120		
1,1-Dichloroethene	20.7	1.00	"	20.0		104	80-120		
Toluene	20.1	1.00	"	20.0		101	80-120		
Trichloroethene	19.5	1.00	"	20.0		97.5	80-120		
Surrogate: 1,2-DCA-d4	39.4		"	40.0		98.5	80-120		
Surrogate: Toluene-d8	38.1		"	40.0		95.2	80-120		
Surrogate: 4-BFB	38.7		"	40.0		96.8	80-120		
<b>Matrix Spike (0F07022-MS1)</b>									
<b>Source: B0F0026-08</b>									
Benzene	22.5	1.00	ug/l	20.0	ND	113	80-120		
Chlorobenzene	20.4	1.00	"	20.0	ND	102	80-120		
1,1-Dichloroethene	23.2	1.00	"	20.0	ND	116	80-120		
Toluene	20.9	1.00	"	20.0	ND	104	80-120		
Trichloroethene	23.7	1.00	"	20.0	3.25	102	80-120		
Surrogate: 1,2-DCA-d4	38.6		"	40.0		96.5	80-120		
Surrogate: Toluene-d8	37.8		"	40.0		94.5	80-120		
Surrogate: 4-BFB	41.2		"	40.0		103	80-120		

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*Laura Cack*

Kirk Gendron, Project Manager

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Project: Seattle ANGS  
Project Number: 6067.26  
Project Manager: Accounts Payable

Reported:  
07/27/00 11:28

**Volatile Organic Compounds (Special List) by EPA Method 8260B - Quality Control**  
**North Creek Analytical - Bothell**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 0F07022: Prepared 06/07/00 Using EPA 5030B [P/T]										
Matrix Spike Dup (0F07022-MSD1)					Source: B0F0026-08					
Benzene	21.9	1.00	ug/l	20.0	ND	109	80-120	2.70	15	
Chlorobenzene	19.9	1.00	"	20.0	ND	99.5	80-120	2.48	15	
1,1-Dichloroethene	23.2	1.00	"	20.0	ND	116	80-120	0	15	
Toluene	20.1	1.00	"	20.0	ND	101	80-120	3.90	15	
Trichloroethene	22.9	1.00	"	20.0	3.25	98.2	80-120	3.43	15	
Surrogate: 1,2-DCA-d4	39.0		"	40.0		97.5	80-120			
Surrogate: Toluene-d8	37.6		"	40.0		94.0	80-120			
Surrogate: 4-BFB	40.9		"	40.0		102	80-120			

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*Laura Chick*

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ERM-Bellevue

915-118th Avenue S.E., Suite 130  
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Project: Seattle ANGS

Project Number: 6067.26

Project Manager: Accounts Payable

Reported:

07/27/00 11:28

### Notes and Definitions

- B Analyte detected in the method blank.
- S-03 The surrogate recovery for this sample is outside of established control limits. Review of associated QC indicates the recovery for this surrogate does not represent an out-of-control condition.
- DET Analyte DETECTED
- ND Analyte NOT DETECTED at or above the reporting limit
- NR Not Reported
- dry Sample results reported on a dry weight basis
- RPD Relative Percent Difference

North Creek Analytical - Bothell

*Laura Creek*

Kirk Gendron, Project Manager

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SEA409400

## Appendix C

APPENDIX C

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**QUALITY CONTROL DATA  
VALIDATION REPORT - MAY 2000  
GROUNDWATER DATA**

## APPENDIX C

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## QUALITY CONTROL DATA VALIDATION REPORT MAY 2000 GROUNDWATER DATA

Analytical data are the basis for evaluating the environmental conditions at the Seattle Air National Guard Station (Seattle ANGS) in Seattle, Washington. A primary objective of environmental sampling conducted at the site is to obtain accurate data that reflect actual conditions.

This report addresses groundwater analytical data collected in May 2000 at the Seattle ANGS as part of a quarterly monitoring program. Thirteen primary groundwater samples were analyzed for volatile organic analytes using United States Environmental Protection Agency (USEPA) Method 8260. To ensure that data quality was acceptable for decision-making purposes, analytical data for this project were validated. This process identifies limitations on the use of the data, or data that should not be used for decision-making purposes. The quality of the data was assessed and any necessary qualifiers were applied following the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (October 1999).

Environmental Resources Management (ERM) validated data for compliance with the following quality assurance/quality control (QA/QC) project- and/or method-prescribed criteria:

- **Holding Time and Preservation:** The holding time is the period of time between collection of the sample and preparation/analysis of the sample. Analyses performed for this project have method-prescribed holding times. Preservation refers to the temperature at which the samples are received at the laboratory, as well as any pH anomalies noted by the laboratory for acid-preserved samples.
- **Calibration:** The analysis of target analytes at a range of concentrations to develop a graphical plot of instrument response against the different analyte concentrations. An initial calibration curve establishes the graphical plot, and the continuing calibration

verification monitors daily instrument linearity against the initial calibration.

- **Blank Samples:** The preparation and analysis of samples from reagent (contaminant-free) water. Blank samples for this investigation included method, rinsate, and field blanks. Compounds detected in a blank sample indicate contamination in the field, at the laboratory, or during sample handling.
- **Internal Standards:** The addition of compounds similar to target analytes of interest that are added to sample aliquots for organic analysis. The internal standards are used to quantitatively and qualitatively evaluate retention time and instrument response for each analytical run.
- **Spike Samples:** The preparation and analysis of an environmental sample or a sample of reagent water spiked with a subset of target analytes at known concentrations. The results of the spike analysis measure laboratory accuracy in the reagent sample, and results from the environmental sample spike measure potential interference from the sample matrix.
- **Surrogate Spikes:** The addition of compounds similar to target analytes of interest that are added to sample aliquots for organic analysis. Surrogate spikes measure possible interference from the sample matrix for the analysis of target analytes.
- **Duplicate Samples:** The preparation and analysis of an additional aliquot of the sample. The results from duplicate analysis measure potential heterogeneity of contaminant concentrations in the samples.

The following data qualifiers were used as appropriate during this validation process:

- U: The analyte was analyzed for, but was not detected above the reported quantitation limit.
- J: The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ: The analyte was not detected above the reported sample quantitation limit; however, the reported quantitation limit was approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R: The sample results were rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte could not be verified.

None of the May 2000 groundwater data were rejected as a result of the data validation process. All of the data, including qualified data, are acceptable and can be used for decision-making purposes.

The following discussion addresses the results of the data validation for each of the QA/QC components listed above.

#### **Holding Time and Preservation**

The USEPA has established maximum recommended holding times and acceptable temperature ranges at which samples must be stored to maintain sample preservation for the analyses performed on the May 2000 groundwater samples. Holding times and sample temperatures extending beyond the maximum can negatively affect sample integrity (e.g., loss of volatile compounds, biodegradation), and impacted samples are qualified depending on the severity of the exceedence and the analytes of concern. The maximum recommended holding time for USEPA Method 8260 is 14 days for acid-preserved samples and 7 days for unpreserved samples. The recommended temperature range for sample storage is 2 to 6 degrees Celsius.

For this project, each analytical result was reviewed for compliance with the method-prescribed holding time and temperature of samples upon receipt at the laboratory. None of the analyses were performed outside of the prescribed holding time and each sample was received within temperature requirements.

#### **Calibration Results**

Before an analytical instrument is used, the instrument should be calibrated to within USEPA method specifications. This calibration ensures that the instrument is appropriately responsive to measurable chemical concentrations. If an instrument is not properly calibrated, it may not be capable of producing acceptable quantitative, qualitative, and reproducible data. For example, positive detections of a given analyte could contain an undetermined degree of inaccuracy if the instrument is out of calibration, although the results may still be considered valid. In the case of non-detections, the associated reporting limit would be

similarly affected; however, such results would still be considered non-detections.

For this project, two types of calibration data were reviewed: initial calibration verification (ICV) and continuing calibration verification (CCV) data. The ICV consisted of standards that were analyzed at five or more concentrations. These concentrations ranged from the reporting limit to the upper linear range of the instrument. Average response factors from the ICV were used to calculate sample results. The laboratory evaluated the ICV data using relative standard deviation (RSD). The reported RSDs were compared to the method-prescribed acceptance criteria during the data validation. The only ICV target analytes with RSDs that exceeded the acceptable method-prescribed criteria were vinyl chloride and methylene chloride. There were no reported detections of vinyl chloride or methylene chloride in the project samples. Therefore the non-detect vinyl chloride and methylene chloride sample results were qualified "UJ," estimated detection limit (Table C-1).

The CCV data are analyzed either daily or every 12 hours to ensure the instrument response is still within method-performance criteria for linearity. The CCV consisted of analyzing a standard at one concentration; the concentration of this standard was generally in the mid-range of the ICV standard concentrations. The laboratory calculated the percent difference (%D) between the CCV and the ICV, and the %Ds were compared to the method-prescribed acceptance criteria during the data validation. The CCV %D data were within method-prescribed limits. None of the May 2000 data were qualified based on unacceptable CCV results.

### **Blank Samples**

Blank samples are prepared in the laboratory or in the field and are carried through the analytical process. The purpose of a blank sample is to test for contamination resulting from laboratory, shipping, or other sample-handling activities. Blank samples are analyzed and evaluated for detections of target analytes. If target analytes are detected in a blank sample, these detections indicate that some element of the sample collection or analysis process has introduced contaminants not present in the original environmental sample aliquot. If target analytes are detected in a blank sample, then all associated data must be evaluated to determine whether:

- Those data have been similarly impacted; or



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**TABLE C-1**  
*Data Qualified Based on Calibration Results*  
 143rd CCSQ, Seattle ANGS, Seattle, Washington

Analytical Parameter	Calibration (ICV/CCV)	Target Compound	RSD or %D	Instrument ID	Date	Associated Samples	ERM Qualifier*
VOCs	ICV	Vinyl chloride/Methylene chloride	40.77/92.04	MS-5	6/1/00	MW-4-99/00-4FA	UJ
						MW-4-99/00-4	UJ
						BS-004PZ-99/00-4	UJ
						MW-9-99/00-4	UJ
						MW-3-99/00-4	UJ
						MW-6-99/00-4	UJ
						MW-5-99/00-4	UJ
						MW-8-99/00-4	UJ
						MW-8-99/00-4D	UJ
						MW-8-99/00-4R	UJ
						MW-10-99/00-4	UJ
						MW-4-99/00-4FT	UJ
						MW-2-99/00-4	UJ
						BS-006PZ-99/00-4	UJ
						BS-005PZ-99/00-4	UJ
						MW-7-99/00-4	UJ
						MW-1-99/00-4	UJ

**Notes:**

%D = Percent difference

CCV= Continuing calibration verification

ICV= Initial calibration verification

D = Duplicate sample

FA = Field blank sample prepared with ASTM Type II water

FT = Field blank sample prepared with tap water

VOCs = Volatile organic compounds

R = Rinsate blank sample

RSD = Relative standard deviation

UJ = Reported detection limits for the listed target compounds are estimated concentrations.

\* Data qualifiers apply to listed samples

- The blank detections are an isolated occurrence not representative of other data.

The three types of blank samples analyzed and reported with the groundwater samples collected in May 2000 were method, rinsate, and field blank samples. Preparation, handling, and analysis of these blank samples are summarized below.

1. Method blank samples monitor for potential laboratory contamination of samples. Method blank samples were prepared in the laboratory by taking an aliquot of reagent water through all preparation and analysis steps. A method blank was prepared and analyzed with each batch of environmental samples.
2. Rinsate blank samples monitor for potential contamination of project samples from inadequate decontamination of sample collection equipment. Rinsate blank samples were prepared in the field by pouring American Society for Testing and Materials (ASTM) Type II reagent-grade water over the decontaminated sample collection equipment. The water was collected in clean sample containers supplied by the laboratory. Rinsate blank samples were labeled with an "R" identifier at the end of the sample ID.
3. Field blank samples monitor for potential contamination of project samples from ambient conditions at the sample collection site. Field blank samples were prepared at sample collection locations by slowly pouring tap water or ASTM Type II water into clean sample containers supplied by the laboratory. Field blank samples prepared with tap water were labeled with an "FT" identifier at the end of the sample ID. The identifier "FA" was used to designate field blank samples prepared with ASTM Type II water.

No target analytes were detected in the rinsate or field blank samples. The common laboratory contaminant methylene chloride was reported in a method blank sample. Methylene chloride was not detected in any of the associated project samples, and none of the results required qualification based on the method blank results.

### **Spike Samples**

A spike sample is a QC sample that is prepared and analyzed by the laboratory. The laboratory prepares, analyzes, and reports spike sample results to demonstrate the ability to properly analyze, detect, and quantify

target analytes. A spike sample result is typically reported as the amount of analyte detected divided by the known amount spiked into the sample, and is commonly referred to as percent recovery. The percent recovery is then compared to an established limit range.<sup>1</sup> The two types of spike samples analyzed with the project samples were matrix and blank spikes.

1. Matrix spike (MS) samples consist of an aliquot of an environmental sample that is spiked with known concentrations of a subset of target analytes. A matrix spike duplicate (MSD) sample is a second (duplicate) spike sample prepared and analyzed with the MS sample. MS samples are used to monitor potential interference from the sample matrix for target analytes. A low MS recovery may indicate low-biased sample results; a high MS recovery may indicate high-biased sample results.
2. Blank spike samples, commonly referred to as laboratory control samples (LCS), consist of an aliquot of reagent water that is spiked with known concentrations of a subset of target analytes. The LCS sample is used to monitor laboratory accuracy without the bias of a sample matrix. LCS recoveries outside of acceptable limits may indicate poor laboratory accuracy.

All MS and LCS recoveries were within acceptable limits. The acceptable MS and LCS recoveries indicate minimal matrix interference and acceptable laboratory accuracy for the May 2000 groundwater data.

#### **Internal Standard Responses**

Under USEPA methods, a given analyte list for organic compounds is segregated by chemical properties and retention time into one or more subsets. A USEPA-defined internal standard with comparable chemical properties and retention times is assigned to each subset of analytes. The laboratory adds a known concentration of an internal standard to each sample, including laboratory QC samples (e.g., calibration standards, MS, method blank samples), prior to analysis. The instrument internal standard response for each sample is compared to the internal standard response in the daily CCV. The sample internal standard area count must be within the range of 0.5 to 2 times the CCV area count, and the retention time must be within  $\pm 30$  seconds of the CCV retention time. If the area

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<sup>1</sup> In most cases, the prescribed analytical method will specify protocol to develop appropriate limit ranges. In some cases, however, limit ranges are established by the laboratory in the method procedures.

count and/or retention time measured for the sample is outside the acceptable range, quantitation results for the associated analyte subset may be biased. Interference from the sample matrix is typically responsible for internal standard responses that are consistently outside acceptable ranges; most matrix interference causes a consistently high or low bias.

Internal standards were added to each of the project samples analyzed for volatile organic compounds. The internal standard responses were within acceptable limits, indicating minimal matrix interference and acceptable sample quantitation.

### **Surrogate Spikes**

A surrogate spike is similar to an internal standard; it is chemically similar to the target analytes and is only used in organic analyses. The difference between surrogate spikes and internal standards is that surrogate spikes are used only to assess possible interference from the sample matrix, whereas internal standards are used to quantitate target analytes while accounting for any interference from the sample matrix. Surrogate spike results are typically reported in terms of percent recovery, which is calculated by dividing the amount of surrogate detected in the sample by the known amount of surrogate added to the sample.

For the May 2000 groundwater data, surrogate recoveries were compared to the laboratory-generated limits of acceptance. The surrogate recoveries were within acceptable limits, with one exception: the 1,2-dichloroethane-d4 surrogate recovery of 79.5 percent for sample MW-8-99/00-4R was below the lower control limit of 80 percent. All target analytes in this sample were non-detect; the results were qualified "UJ," estimated. The surrogate recoveries within acceptable limits in the remaining samples indicate that the sample results were not subject to interference from the sample matrix.

### **Duplicate Samples**

A duplicate sample is a second aliquot of a sample that is treated the same as the primary sample. A duplicate sample analysis is performed to measure the precision of the method and possible heterogeneity of analyte concentrations in the sample matrix. Duplicate field samples are collected to measure matrix heterogeneity.

Laboratory duplicate analyses for the project samples consisted of MSD analyses. The laboratory calculated the relative percent difference (RPD) between the MS and MSD spike concentrations. The calculated RPDs were compared to method-prescribed or laboratory-generated acceptable limits. A field duplicate sample also was collected and submitted for analysis, and an RPD was calculated for detected analytes.

The duplicate sample RPDs were within acceptable limits, indicating acceptable analytical precision and minimal matrix heterogeneity.

#### **Overall Assessment**

None of the Seattle ANGS analytical data for groundwater samples collected in May 2000 were rejected; the calculated data completeness is 100 percent. The data can be used for decision-making purposes, and the quality of the data is acceptable for the preparation of technically defensible documents.

**Appendix D**

KCSlip4 42882

SEA409412

**FINAL**

**APPENDIX D**

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***CHAIN-OF-CUSTODY FORMS***

KCSlip4 42883

SEA409413

# CHAIN OF CUSTODY REPORT

Work Order #: **BOF0026**

CLIENT: <b>ERM</b>				INVOICE TO: <b>Accounts Payable Walnut Creek</b>				<b>TURNAROUND REQUEST in Business Days*</b> Organic & Inorganic Analyses <input checked="" type="checkbox"/> 7 <input type="checkbox"/> 5 <input type="checkbox"/> 4 <input type="checkbox"/> 3 <input type="checkbox"/> 2 <input type="checkbox"/> 1 <input type="checkbox"/> <1 STD. Petroleum Hydrocarbon Analyses <input type="checkbox"/> 5 <input type="checkbox"/> 4 <input type="checkbox"/> 3 <input type="checkbox"/> 2 <input type="checkbox"/> 1 <input type="checkbox"/> 21 STD. <input type="checkbox"/> OTHER Please Specify			
REPORT TO: <b>Rob Leet</b>				P.O. NUMBER: <b>6067.26</b>							
ADDRESS: <b>915 118th Ave SE, Ste 130 Bellevue, WA 98008</b>				PHONE: <b>425-455-3973</b> FAX: <b>425-462-8571</b>							
PROJECT NAME: <b>6067.26 PANGB</b>				PROJECT NUMBER: <b>7</b>							
SAMPLED BY: <b>Chris Bailey</b>											
CLIENT SAMPLE IDENTIFICATION		SAMPLING DATE/TIME		REQUESTED ANALYSES							
1. MW-4-99/00-4 FA		5/30/00 1510		<div style="writing-mode: vertical-rl; transform: rotate(180deg);">VOC 8260</div>							
2. MW-4-99/00-4		5/30/00 1525									
3. BS-004/99/00-4		5/30/00 1300									
4. MW-9-99/00-4		5/30/00 1200									
5. MW-3-99/00-4		5/30/00 1340									
6. MW-6-99/00-4		5/30/00 1415									
7. MW-5-99/00-4		5/30/00 1450									
8. MW-8-99/00-4		5/30/00 1555									
9. MW-8-99/00-4 D		5/30/00 1555									
10. MW-8-99/00-4 R		5/30/00 1615									
11. MW-10-99/00-4		5/30/00 1120									
12. MW-4-99/00-4 FT		5/30/00 1520									
13.											
14.											
15.											
RELINQUISHED BY: <b>Andrew Bull</b> FIRM: <b>ERM</b> DATE: <b>5/31/00</b> TIME: <b>1625</b>				RECEIVED BY: <b>Adam Reed</b> FIRM: <b>NCA-B</b> DATE: <b>6/1/00</b> TIME: <b>17:30</b>							
RELINQUISHED BY: FIRM: DATE: TIME:				RECEIVED BY: FIRM: DATE: TIME:							
ADDITIONAL REMARKS: <b>use MW-S as MS/MSD ; please report in level 4 GLP format</b>								TEMP: <b>11/2</b>			



(425) 420-9200 FAX 420-9210  
(509) 924-9200 FAX 924-9290  
(503) 906-9200 FAX 906-9210  
(541) 383-9310 FAX 382-7588

## CHAIN OF CUSTODY REPORT

Work Order #: BOF0026

CLIENT: ERM REPORT TO: Robert ADDRESS: 915 118th Ave SE Ste 130 Bellevue, WA 98005 PHONE: 425-462-8591      FAX: 425-455-3573			INVOICE TO: Accts. payable Walnut Creek, CA  P.O. NUMBER: 6067.26		
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PROJECT NAME: PANGB PROJECT NUMBER: 6067.26 SAMPLED BY: Andrea Balla			REQUESTED ANALYSES		
--	--	--	--------------------	--	--

CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	VOCs \$260										
1. MW-2	5/31/00 1008	X										
2. BS-006PZ	5/31/00 1119	X										
3. BS-005PZ	5/31/00 1207	X										
4. MW-7	5/31/00 1316	X										
5. MW-1	5/31/00 1412	X										
6.												
7.												
8.												
9.												
10.												
11.												
12.												
13.												
14.												
15.												

TURNAROUND REQUEST in Business Days*				
Organic & Inorganic Analyses				
<input checked="" type="checkbox"/> 7	<input type="checkbox"/> 5	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2
<small>STD.</small>				
<input type="checkbox"/> 5	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1
<small>Petroleum Hydrocarbon Analyses</small>				
<input type="checkbox"/> 5	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1
<small>STD.</small>				
<b>OTHER</b> Please Specify _____				
*Turnaround Request less than standard may incur Rush Charges.				

MATRIX (W, S, O)	# OF CONT.	COMMENTS	NCA W ID
w	2	BOF0026	13
w	2		14
w	2		15
w	2		16
w	2		17

RELINQUISHED BY: <i>Andrea Balla</i> PRINT NAME: Andrea Balla FIRM: ERM	DATE: 5/31/00 TIME: 1425	RECEIVED BY: <i>Adam Reed</i> PRINT NAME: Adam Reed FIRM: NCA-B	DATE: 6/1/00 TIME: 17:30
RELINQUISHED BY: PRINT NAME: FIRM:	DATE: TIME:	RECEIVED BY: IT NAME: FIRM:	DATE: TIME:

ADDITIONAL REMARKS:

KCslip4 42885

SEA409415